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**Former Analyst Heads
Project To Help Supply Chains
Prepare for the Unpredictable**

**In Pursuit
of Supply-chain
Excellence**



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Former Analyst Heads Project To Help Supply Chains Prepare for the Unpredictable

A conversation with Larry Lapidé, research director of Supply Chain 2020, a project of the MIT Center for Transportation & Logistics.

Larry Lapidé was tapped a year ago to head a multi-year research effort looking into the future of logistics and supply-chain management that was initiated by the MIT-Zaragoza International Logistics Program. Immediately prior to accepting this post, Lapidé served in various executive positions with AMR Research, Boston, where he specialized in supply-chain research and analysis. Previous to AMR, he managed a variety of supply-chain projects at Accenture for high-profile customers in both the U.S. and Europe. Lapidé also has worked with Data General, Arthur D. Little, and Benchmarking Partners, and as a lecturer in the Management Sciences department of the University of Massachusetts. He holds a Ph.D. in operations research from the University of Pennsylvania's Wharton School, a master's in electrical engineering from MIT, and a bachelor's in electrical engineering from The Cooper Union—all of which qualified him as a self-described "egghead" in the non-academic worlds in which he had previously worked.

Q: What attracted you to the job at the MIT Center for Transportation and Logistics (CTL)?

Lapidé: I'll give you a little background. Professor Yossi Sheffi (CTL director) had spent a year on a sabbatical at Cambridge University in England. While he was there, he ran into some people from the state of Aragón in Spain and these people wanted to build competency in the logistics area. They had taken an abandoned U.S. Air Force base and converted it to a state-of-the-art logistics park, called PLAZA. They had created a private group to run the park and to sign up companies that would put distribution and light manufacturing facilities on this plot of land.

But, as they talked to Yossi, one of the things they recognized was that, in order to develop a strong logistics base, they needed an institution to train people in logistics. And they wanted MIT to help with that. So, after some discussions, a multi-year education and research partnership was struck between PLAZA, the government of Aragón, MIT's CTL and the University of Zaragoza, which is

located in Aragón's capital city. The academic part of this partnership is the creation of a graduate school of international logistics and supply-chain management. The first classes began in September of 2004 with courseware that is modeled after the MIT Master of Engineering in Logistics program. This is an international program that is taught in English and marketed to students from all over the world. It is called the MIT-Zaragoza International Logistics Program. Already we have more students for this program than we expected. Next year we start the Ph.D. program and launch more executive education short courses. But we are beginning with the international program and that is the one MIT is most involved with from an academic perspective.

Now, the research piece of the partnership. It is aimed at doing research that is global and that is about the future of the supply chain and what companies need to do to be ready for the future. Yossi wanted to get ahead of the curve to research where things are going rather than the more traditional academic research that typically looks at the past and the present. He was looking for someone outside of academia to run the research project, which we are calling Supply Chain 2020. He went around and talked to people he knew who were, frankly, a little older, and who were in reasonably good financial shape. But also people who wanted to do something interesting and unique. That's the pitch he gave me, and it worked. I essentially have had three careers and I am at an age where the idea of doing something unique and challenging and important appealed to me. I have a Ph.D., so I always was an academic at heart anyway and the opportunity to be in academia again was intriguing. But really it was the topic itself—to work on a big project looking at the future of the supply chain was a dream job.

Q: How did you decide where to begin?

Lapidé: I spent the first seven or eight months at MIT just figuring out what we were going to do, what research we would try to conduct and how



we would go about it.

We have divided the project into two phases and we have started Phase I, which is basically a one-year study to determine what makes excellent supply chains. We want to do much more in-depth research than has been done before on why some supply chains work very well, versus the hype that you see out there. In consulting and the analyst environments it was all about the short-term—what is the latest hot process or technology. But here we have to be much more diligent in our research and really understand the underlying critical success factors of a supply chain, in the long run. Before we can talk about the future of the supply chain we first want to understand what makes a great supply chain today.

Q: How are you doing that?

Lapide: That gets to the structure of the project. We decided we needed a group of people to serve as a guidepost, so we created an Industry Advisory Council (IAC). Since we want to make the research applicable to industry, we wanted to pull about 20 people from industry to serve on the IAC. They will provide us feedback on the project and give us ideas, but also provide source material for the research. In creating this council, I looked for people who have been around the business from 15 to 25 years and who are passionate about the supply chain. This wasn't necessarily the people with the biggest titles—they didn't have to be vice president of supply chain. I was more interested in the person who was a thought leader. So we selectively invited people to participate and pretty much everyone we invited agreed to serve. We ended up with 26 great people, whose names are all listed on our web site. [Ed. Note: visit <http://wet.mit.edu/ctl/www/>.] About 80 percent of them are from corporations and the other 20 percent are from suppliers—software companies, consultants and 3PLs. I wanted people who see the business of supply chain across all types of companies.

But when we stepped back and looked at this council we realized that nearly all of the members were with U.S.-based companies. Because this is a global study, we also wanted to get a European perspective, so we created a European Advisory Council as well. That group has 14 members—again, people who have been in the business for a long time and who are with fairly well known companies. Together we have

about 40 people on councils. So that is one source of research.

Being academics, we also do literature searches to see what has been done in this field in the past, which is our second source of research. And the third piece will be visits and interviews with companies—IAC members and others—to talk about their supply chains, as case studies. We may even talk to their suppliers and customers. So those are the three primary sources we are using.

The people actually doing the research work are our students and our faculty. In addition, we are working with some other academic institutions that have expressed interest. For example, we are just starting some research with Dr. Hau Lee at Stanford on the future of logistics parks. Over time,



Larry Lapide

we want to extend this out beyond MIT to other institutions.

Q: What will you focus on in Phase Two?

Lapide: OK, so the first step is to understand supply chains today. The second step is to understand how those supply chains might evolve over time. In order to do that, we have to understand the macro factors, such as how China might develop. China's story today is primarily about low-cost manufacturing. In 2020, China's story might be all about consumption. If it becomes a world superpower, it also will become a consuming nation, and it may not even be the low-cost manufacturing place anymore. So how would that shift alter global supply chains?

I like to talk about \$200-per-barrel oil. In 2020, it is conceivable that the oil supply will be much shorter and cost a lot more than it does today. How will that impact supply chains?

In the second phase of this research, we need to start looking at what is going to happen to supply chains based on the

trends we see today and the macro factors that might impact those trends. That is what the latter part of the project will be about.

Now, there are two types of macro factors. One is external forces that lie outside of the company, that really are out of its control—things like government regulations, globalization of trade, what happens to China and so on. But there also are supply-capability macro factors like technology that companies can use to adjust and modify and improve their supply chain. This also includes process innovation, manufacturing advances and so on.

To look at these we are going to use a methodology called scenario planning. This is NOT forecasting. That's a critical point. You can't forecast 10 to 15 years out because the world is changing too quickly. It just doesn't work.

So scenario generation really is about identifying possible futures and then asking how supply chains would have to adapt in that environment. It is more about preparing companies for what might happen rather than telling them what is going to happen. We don't know what is going to happen. But the idea is to help companies be in a position where they are flexible enough to be able to adapt to whatever the future holds. So that is the final product of all of this—to be able to help companies figure out what kinds of strategies to put in place today that will prepare them for multiple possible futures; and to identify stakes in the ground—things they need to watch over time—to see which of these futures is developing and to make adjustments. That is the final product.

Q: How do you think the pace of change during the next 15 years will compare with the past 15 years?

Lapide: I think things will change even more rapidly in the next 15 years. That's why we can't forecast, why we have to look at possibilities. And it's why you really can't leverage current trends by projecting them out.

And it is why I am so excited about this project. I believe this is the first effort to look at the future of the supply chain in a formal research-driven way. It is unique and it is important and it is big and I am really happy to be involved. ○

A longer version of this interview is available online. Visit The Library at www.supplychain-brain.com, category: Interviews/Opinions.

In Pursuit of Supply-chain Excellence

Supply Chain 2020, a project of the Center for Transportation and Logistics at MIT, creates a framework for determining what makes a supply chain excellent now, and in the future.

For at least a decade, industry gurus have told us supply-chain excellence is the key to gaining competitive advantage. Unfortunately, these same experts have neglected to tell us what constitutes an excellent supply chain, let alone how to achieve such excellence. As a result, companies have simultaneously been trying to minimize costs, increase customer responsiveness, and maximize asset utilization, all while emulating the latest best practice hyped by industry consultants.

Such efforts don't always work, according to Larry Lapide, research director for the Massachusetts Institute of Technology Center for Transportation and Logistics (MIT CTL), mainly because there may be little connection between these companies' competitive strategies and their supply-chain processes, operations and practices.

"Supply chains are as unique as individuals," he says. "Neither can be all things to all people."

Lapide also has a problem with most ranked lists of "top supply chains" because they tend to over-simplify the appropriate

metrics or pick the wrong metrics altogether. For example, Lapide says that a short-term connection between a company's financial performance and the quality of its supply chain is unlikely.

"Cisco had fantastic financial results a few years ago and then fell on difficult times when the internet bubble burst and demand plummeted," he says. "Their supply chain was excellent when they were flying high, and it was still excellent when their financial results fell. To believe otherwise would mean their supply-chain's excellence changes quarter to quarter!"

Nor is any single set of metrics, such as low-cost or high-service, a reliable proxy for supply-chain performance. Lapide says that a company's strategic positions—whether it's customer intimacy, operational efficiency or product superiority—require operating against a balanced set of different metrics that align to the business strategy.

"Excellent supply chains support the strategic imperatives of an organization needed to compete effectively," he says.

For example, a customer-focused strategy for a company such as Best Buy requires

relative high inventory and significant costs for customer interaction. That strategy is very different from a cost-minimizing model such as Wal-Mart's. Both supply chains are excellent, but competitive strategy will determine the operational metrics that are appropriate for any given organization.

Defining exactly what constitutes an excellent supply chain is the first objective of a three-year project that Lapide now heads up. Called Supply Chain 2020, the project's ultimate goal is to look into the future of supply-chain management to help companies prepare for the events and trends that are likely to impact supply chains in the next 10 to 15 years. For example, what will happen to global supply chains if gradual fuel price increases give way to skyrocketing costs owing to oil shortages? How might a consumer goods company design its supply chain if, by law, all packaging had to be shipped back to a recycling center? How might an apparel maker or consumer electronics firm deal with a world that has no low-cost producer countries such as China or the Philippines? The 2020 project will be looking at such scenarios over the next few

years to help companies prepare for them, should they come to pass.

Supply Chain 2020 is actually a project initiated by the MIT-Zaragoza International Logistics Program. The global project involves dozens of faculty, research staff and students at MIT and other institutions around the world. Two groups of supply-chain executives from leading companies from around the world keep the project firmly grounded in practicality. Currently, the largely U.S.-based Industry Advisory Council (IAC) consists of 25 members, and the European Advisory Council (EAC) includes 15 members.

“To help understand what will make supply chains excellent in 2020, we need to understand what makes them excellent today,” says Lapide. “The 2020 research does much more than just document so-called best practices, because council members already have that information.”

Instead, the project is also mapping and modeling the relationship between the current range of practices and the current range of underlying business and economic factors that drive the selection among those practices.

Characteristics of Excellence

In the six months or so that Supply Chain 2020 has been under way, the IAC and EAC have concluded that excellent supply chains have four characteristics:

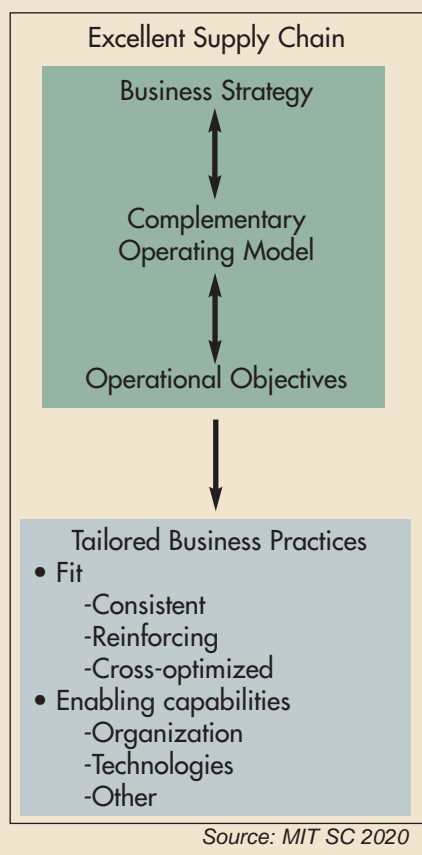
1) They both support and enhance the strategy of the business, by being an integral part of the overall design of the business.

2) Excellent supply chains are based on a complementary, not necessarily unique, operating model that creates competitive advantage.

3) They emphasize high-performance execution, where performance is measured by a balanced set of business-relevant objectives or metrics.

4) Excellent supply chains leverage a tailored set of business practices. Specifically, strategy, operating models and operational objectives are interrelated and mutually supportive. The tailored set of business practices, a subset of all possible business practices, are chosen to reinforce each other and for their ability to support the strategy, operating model and objectives of the organization. The use of the term tailored practices, rather than best practices, reflects the alignment of the practices to holistically fit the context of the organization.

Figure One:
Excellent Supply Chain
Research Framework



Thus, an excellent supply chain will almost always be found in companies that have a clear business strategy enabled by a complementary operating model aimed at achieving a balanced set of operating objectives. At a more detailed level, the operating model comprises a tailored set of business practices and the right enabling capabilities (See Fig. One).

For example, Dell is universally viewed as having an excellent supply chain, but few people can explain why it's good other than to point to their innovative practices and financial performance. Lapide sees the reasons very clearly. Dell's strategy is to sell good computer equipment at a good price. To keep the price low, they don't use traditional retail. They sell direct via phone and internet to customers who primarily know what they want and don't need a lot of handholding. Dell supports this strategy with the build-to-order model driven by operating objectives, including low cost and price, availability of product, fast and accurate fulfillment, etc.

Dell's business practices include supplier consigned inventory that Dell does not own but is just close to the plant. Dell just

assembles orders and sends them out. The company is able to minimize inventory and maintain a great cash-to-cash cycle. They work tightly with suppliers to help them decide what items to hold in their inventory. Dell knows what is in the supplier inventory, so if an item is out of stock, they will not offer it on the web. If there is an excess of an item, Dell will lower the price to drive customers to what they have.

“Dell has tightly fit together their metrics, their unique operating model, their business strategy and their highly-crafted tailored business practices,” says Lapide. “That is how they compete so well with HP, IBM and everyone else.”

Lapide points out that IBM, which competes with Dell in certain markets, also has an excellent supply chain, but it's completely different from Dell's. IBM's strategy is to support all of its customers' technology needs. They are a diversified technology company providing both products and services.

“IBM assembles very complex systems for their customers and then supports them over their life,” says Lapide. “IBM's supply-chain metrics are more focused on customer responsiveness in a more encompassing way and over the long haul.”

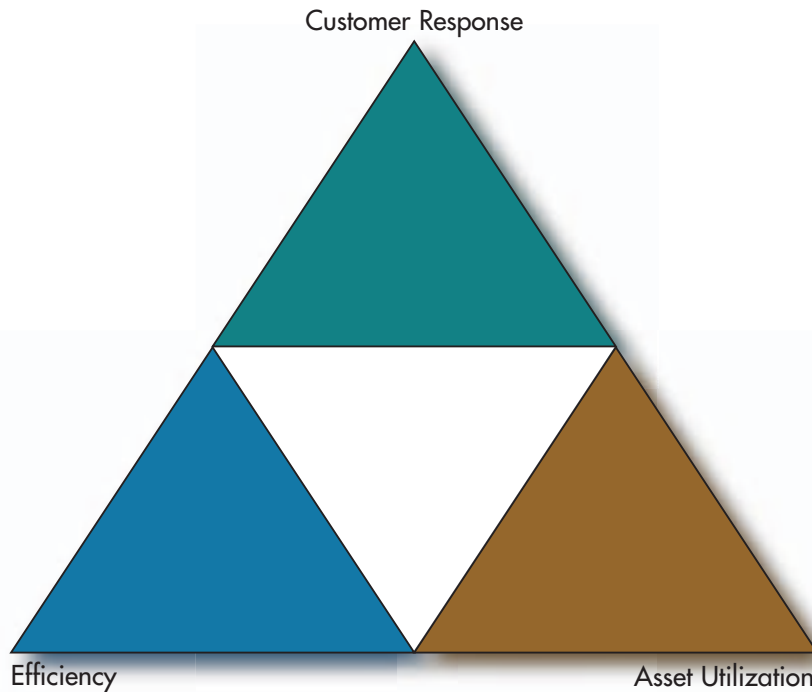
Operational Objectives

The current model that the 2020 project is using to determine supply-chain excellence is based on how well a company achieves its operational objectives. These objectives codify what is important to the company. They are the metrics that the company relies upon to drive its supply-chain performance. Lapide puts these operational objectives into three separate groups that support distinctly different business strategies and operating models.

1) Customer Response: Operational objectives such as order cycle time, perfect order fulfillment rates, quality, and new product time-to-market are all objectives that assess the external, customer-facing side of the company. Companies in industries with high-margin, short-lifecycle products often emphasize this set of objectives. These industries include pharmaceuticals, fashion apparel, toys, and computers.

2) Efficiency Objectives: These operational objectives are internal measures that can assess how well the company converts inputs into output. Examples include labor productivity, labor content, supply-chain

Figure Two: Mapping Operational Objectives



Objective:

Customer Response (customer-facing)

Metrics:

Order cycle times, perfect order fulfillment, quality, new product time to market

Characteristics:

High margin, short life cycle products to include pharmaceuticals, fashion apparel, toys, electronic games, books, music and computers

Examples:

Best Buy, Apple

Objective:

Efficiency (internal)

Metrics:

Labor productivity, supply chain costs

Characteristics:

Low margin, mature products to include food and beverage, consumer electronics, non-fashion retail, parts and components.

Examples:

Wal-Mart, Dell

Objective:

Asset Utilization (internal)

Metrics:

Facility utilization, inventory turns, cash-to-cash cycle

Characteristics:

Capital intensive, 7 X 24 operations to include semi-conductor, petrochemical, steel, pulp/paper, coal and other commodities.

Examples: Amazon, IBM

costs, wastage, etc. Cost-conscious companies such as food and beverage, consumer electronics, non-fashion retail, and industrial supplies often focus on these types of metrics.

3) Asset Utilization Objectives: These operational objectives are also internal measures, however, they focus instead on how effectively the company is leveraging its assets such as facilities, inventories and working capital (e.g., cash). Capital-intensive industries, for example, such as semiconductor fabrication, petrochemicals, and commodity materials (steel, paper, and coal) makers, all try to make the most of their plant and equipment with 24x7 operations.

These three groups can be represented graphically through a triangle—each group of objectives being a corner of the triangle. Companies can be mapped on this diagram according to the relative focus of their supply chains. (See Fig. Two). A capital-intensive company, such as a steel-maker, might reside in the “asset utilization” corner of the triangle. Companies that combine objectives would sit somewhere in the middle of the triangle. For example, an airline might sit halfway between “asset utilization” and “customer response” because it both requires substantial assets and emphasizes timely service.

Whether or not a company has an excellent supply chain goes one step beyond the mapping process. The company must employ tailored practices, technologies, and collaborative relationships that meet the metrics for its chosen operating objectives. In other words, it must execute very well, and execute consistently. If all of these factors align, the supply chain is excellent under this model.

As the 2020 Council members point out, this operational objectives model requires further clarification because large companies are likely to have multiple supply chains for different divisions, products and brands. The operational objectives will also vary. For example, the Borealis Group has a chemical plant in Abu Dubai that never shuts down, with asset-utilization as the primary operational objective. On the other hand, some other Borealis plants can be shut down when demand is low, and here the focus is on other objectives such as low cost. General Dynamics is a company that makes Gulfstream jets for business executives, armored tanks for the U.S Army, and nuclear submarines for the Navy. Each division calls for its own supply-chain design, with its own set of strategies and objectives driving it.

Source: MIT SC 2020

Figure Three: Supply Chains That Excel

Company	Why Their Supply Chains Excel
Amazon	<ul style="list-style-type: none"> • Leverages its e-commerce infrastructure and its learnings with ever-increasing product assortment • Online expertise allows deep customer connection and assured response • Real-time visibility to supplier inventory allows dynamic sourcing from alternate providers as needed • Pulls the supply chain in real time using analytical models
Apple Computer	<ul style="list-style-type: none"> • Industry leader in introduction of innovative consumer electronics • Orients its supply chain to product development to keep it ahead of competitors to maintain high margins • Outsources non-core manufacturing and logistics • Increasingly using own stores to connect directly to customers
Best Buy	<ul style="list-style-type: none"> • Sells the latest, most sought-after consumer electronics • Maintains high margins with in-stock availability and high customer service
C&S Wholesale Grocers	<ul style="list-style-type: none"> • Low cost distributor to grocery retailers • Uses size and volume to negotiate low prices • Nationwide network of highly efficient warehouses • Drives sales and profits with good use of incentives and labor productivity
Cisco	<ul style="list-style-type: none"> • Single-source provider of networking equipment for diverse global customers. • Acquires and rapidly integrates innovative technology companies to maintain product innovation • Relies on outsourced manufacturing and distributed order management to fulfill diverse customer needs
Dell	<ul style="list-style-type: none"> • Provides best price for savvy computer equipment buyers • Relies on build-to-order direct sales and customized bundles of standardized products • Shapes demand with daily changes in pricing and configurations to guide customers to PCs that it can fulfill quickly
Frito-Lay	<ul style="list-style-type: none"> • Manages its supply chain end-to-end • Uses demand signals from individual store levels and moves back through their delivery, fulfillment and production operations • Manages deliveries based on pull signals from individual stores
IBM	<ul style="list-style-type: none"> • Highly integrated supply chain that links sales and operations • Product development and supply-chain performance guided by sales call feedback
InBev (Belgium-based brewer)	<ul style="list-style-type: none"> • As the biggest and most profitable brewer in the world, it uses size to dominate markets • Agile supply chain allows merging distribution networks from acquired companies without interruption • Adopts and integrates best practices of acquired companies
McDonald's	<ul style="list-style-type: none"> • Efficient store operations allow price competitiveness • Sources locally to support time-sensitive nature of the fast-food business • Manage its cost and service levels as a global supply chain
Nokia	<ul style="list-style-type: none"> • Provides innovative products and achieves short time to market • Designs new products in-house, but reduces risk and remains asset-light by outsourcing manufacturing • In product design, Nokia often re-uses technology platforms and components, which is a strategy to minimize the supply-chain cost of bringing new products to market
Procter & Gamble	<ul style="list-style-type: none"> • Uses a brand leadership in diverse product sectors to grow sales worldwide • Sustains brands with product innovation and a supply-chain model that emphasizes shelf availability • Fine-tunes product-upgrades and cross company coordination of promotions • Effective measurements ensure that products are there when consumers want them
POSCO (Korean Steel producer)	<ul style="list-style-type: none"> • Provides exactly the right steel customers need when they need it • Leverages production assets to provide wide variety of steel products and specifications • Tightly linked to customers to use demand signals to drive production • Delivers quickly to customer plants

Continued on next page.

Figure Three Continued

Company	Why Their Supply Chains Excel
Southwest Airlines	<ul style="list-style-type: none"> • Operations focused on the class of customers that wants efficiency, not amenities. The airline has invented the "people supply chain," which applies SCM to travel • Ground operations supported by efficient maintenance and spare parts supply chain
Target Stores	<ul style="list-style-type: none"> • Low-cost, high-volume retailer with promotion-driven marketing • Uses supplier collaboration to enable differentiation • Wider assortment of products than its prime competitor
Toyota	<ul style="list-style-type: none"> • Excels at developing deeply collaborative relationships with suppliers that enables mutual understanding • Shares demand data with suppliers • Tracks supplier performance and works with them to correct problems
Wal-Mart	<ul style="list-style-type: none"> • Lowest-price retailing based on high volumes and low supplier cost • Lowest cost-to-shelf through operational innovations (such as RFID) • Drives efficiency with automated logistics, large-format stores that leverage economies of scale, and co-managed inventory programs • Sells only low-risk products
Zara (Spanish retailer)	<ul style="list-style-type: none"> • Provides unique and innovative fashion products at low prices • High-turn retail strategy that creates sales velocity by fostering scarcity • Integrates design function, production, and point-of-sale demand to respond quickly to changing fashion trends • Store managers provide the most updated demand information

Source: GL&SCS

Products that have strong brand equity, price-insensitivity, and high profit margins need to be focused more around customer response goals, while price-sensitive, higher-volume brands need to be focused more on efficiency objectives because of competition and lower margins. In the automotive parts industry, there is a set of products with stable (predictable) demand for which operational objectives focus on providing a cheap and efficient supply chain. The unstable (unpredictable) parts, that are asset-intensive and subject to faster demand changes, need a flexible supply chain. Thus, companies often need to address different needs in supply-chain management, rather than building a one-for-all solution for different brands or products.

Operational objectives also evolve over time, according to Council members. For example over the history of Novartis, a company formed by the merger of two companies, the initial focus was on asset-utilization, then on customer service, and then on cost efficiencies. When first formed, Lucent focused a lot on customer response because of the high growth it was experiencing in high margin businesses, yet more recently it has a greater focus on asset-utilization, as exemplified in its out-

sourcing of manufacturing. As the business environment and a company's core competencies change over time, operational objectives change accordingly.

As competitive strategies evolve over time, operational objectives also change and are almost always unequally balanced. As corporate boards meet to alter business strategy and change priorities in a changing competitive climate, supply-chain objectives will also need to change—often placing a greater focus on one type of operational objective over the others.

So which companies have excellent supply chains? The Supply Chain 2020 project team has a long list of company names that it is researching across 10 different industries.

"We have over 20 researchers working with the Council members to look very closely at these supply chains and how they support the companies business strategies," says Lapide. "Frankly, we are far more interested in identifying the critical success factors that make a supply chain work well, rather than producing a list of top supply chains."

Although this supply-chain analysis is only one part of the 2020 project, Lapide is eager to share with the industry the models and framework his team is using to conduct its research.

"It is important to have our industry view supply-chain excellence in the right perspective," he says. "Supply-chain excellence is not just about one year's great service levels or financial performance. Real excellence is performance that supports the business strategy and makes the company competitive year after year."

MIT's Supply Chain 2020 project has provided GL&SCS with the framework for determining excellence and sources of information about companies worthy of consideration. Based on our own research and the criteria that MIT has provided, we have put together a list of excellent supply chains, based on how the companies' metrics, practices and execution support their business strategy and operating model.

The names of these companies, along with a description of their business strategies, metrics and practices are in the accompanying table (Fig. Three).

"The important take-away from this exercise must be to appreciate what it really takes to create an excellent supply chain," says Lapide. ○

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